

We claim:

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1. An intake air heater capable of being mounted in an intake air manifold formed integrally in a cylinder head of an internal combustion engine for heating intake air flowing along an intake air flow path to multiple engine cylinders, comprising:

5 a heater frame member for attachment to the cylinder head; and
a heating element connected to said heater frame member for heating the intake air, wherein said heating element is positioned within the integral intake air manifold formed in the cylinder head when the air heater is
10 mounted on the engine.

2. The intake air heater of claim 1, wherein said frame member further includes a flange portion positioned substantially in a single mounting plane, said heating element positioned on one side of said mounting plane along said intake air flow path downstream of said flange
15 portion.

3. The intake air heater of claim 2, wherein said frame member is elongated in shape and said flange portion extends peripherally around said elongated frame member.

4. The intake air heater of claim 3, wherein said frame member
20 further includes two side wall portions extending from said flange portion transverse to said mounting plane, said heating element mounted between said two side wall portions.

5. The intake air heater of claim 4, wherein said heating element is an electric resistance heater and one of said side wall portions includes an access port for providing access for an electrical connection between an electrical source and said heating element.

5 6. An intake air delivery assembly for delivering intake air to multiple cylinders of an internal combustion engine having an engine block, comprising:

 a cylinder head mounted on the engine block including an integral intake manifold chamber formed therein for delivering intake air to the
10 multiple cylinders; and

 an intake air heater means mounted at least partially in said integral intake manifold ^{chamber} for heating the intake air.

 7. The intake air delivery assembly of claim 6, wherein said cylinder head includes a bottom surface for engaging said cylinder block, a top surface formed opposite said ^{bottom} ~~top~~ surface and a plurality of side
15 surfaces connecting said bottom and top surfaces, said integral intake manifold chamber being formed in one of said top and said plurality of side surfaces.

 8. The intake air delivery assembly of claim 7, wherein said
20 integral intake manifold chamber is formed in said top surface.

 9. The intake air delivery assembly of claim 7, wherein said intake air heater means includes an electric resistance heating element, said cylinder head including a connector aperture formed in one of said plurality

of side surfaces, further including an electrical connector extending through said connector aperture to provide an electrical connection between said electric resistance heating element and an electrical source.

5 10. The intake air delivery assembly of claim 8, wherein said intake air heater means includes a heating element and a heater frame supporting said heating element, said heater frame including a mounting flange extending along said top surface of said cylinder block and side walls extending from said mounting flange into said integral intake manifold chamber for supporting said heating element.

10 11. The intake air delivery assembly of claim 10, wherein said heater frame is elongated in shape and said mounting flange extends peripherally around said heater frame.

15 12. The intake air delivery assembly of claim 9, wherein said air heater means further includes a heater frame supporting said heating element, said heater frame including an access port, said electrical connector extending through said access port to electrically connect with said heating element.

20 13. The intake delivery assembly of claim 9, wherein said electric resistance heating element is positioned entirely within said integral intake manifold chamber.

 14. The intake air delivery assembly of claim 10, further including an air delivery conduit mounted adjacent said top surface of said cylinder

head, said delivery conduit defining an air delivery passage communicating with said integral intake manifold, said air delivery conduit including a conduit flange, each of said conduit flange, said heater mounting flange and said top surface of said cylinder head including a plurality of mounting apertures, further including a plurality of mounting bolts, each of said mounting bolts extending through a respective set of said mounting apertures to engage said cylinder head so as to secure said air delivery conduit and said heater frame to said cylinder head.

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10 15. An intake air delivery assembly for delivering intake air along an intake air flow path to multiple cylinders of an internal combustion engine having an engine block, comprising:

15 a cylinder head mounted on the engine block including an integral intake manifold chamber formed therein for delivering intake air to the multiple cylinders, said cylinder head including a first surface for engaging said cylinder block and a second surface formed opposite said first surface;

an air delivery conduit mounted on said cylinder head adjacent said second surface, said delivery conduit defining an air delivery passage communicating with said integral intake manifold chamber; and

20 an intake air heater means mounted along the intake air flow path, said intake air heater means including a heating element positioned in one of said integral manifold chamber and said delivery conduit, and a heater frame member for supporting said heating element, said frame member including a flange portion positioned in compressive abutting relationship between said air delivery conduit and said second surface of said cylinder head, said flange portion having a predetermined minimal thickness for

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minimizing the distance between said air delivery conduit and said top surface of said cylinder head.

5 16. The intake air delivery assembly of claim 15, wherein said flange portion is positioned substantially in a single mounting plane, said heating element positioned on one side of said flange portion along said intake air flow path downstream of said mounting plane.

17. The intake air delivery assembly of claim 16, wherein said frame member and said heating element are elongated in shape and said flange portion extends peripherally around said frame member.

10 18. The intake air delivery assembly of claim 15, wherein said heater frame member further includes two side wall portions extending from said flange portion into said integral intake manifold chamber, said heating element mounted between said two side wall portions, said heating element being an electric resistance heater.

a 15 19. The intake air delivery assembly of claim 14, wherein said air delivery conduit includes a conduit flange, each of said conduit flange, said heater flange portion and said ^{top}~~second~~ surface of said cylinder head including a plurality of mounting apertures, further including a plurality of mounting bolts, each of said mounting bolts extending through a respective aligned set of said mounting apertures to engage said cylinder head so as to secure said air delivery conduit and said heater frame member to said cylinder head.

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- 5 20. The intake air delivery assembly of claim 15, wherein said heating element includes an electric resistance heating element and said cylinder head includes a plurality of side surfaces connecting said first surface and said second surface, said cylinder head including a connector aperture formed in one of said plurality of side surfaces, further including an electrical connector extending through said connector aperture to provide an electrical connection between said electric resistance heating element and an electrical source.

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